Vehicle Routing in practice

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The Vehicle Routing Problem (VRP) is one of the most well-studied combinatorial optimization since it was introduced in 1959 [1]. VRP instances of relevant practical size typically number from hundreds of customers to well into the thousands of customers with hundreds of available heterogeneous vehicles. Because many additional practical constraints are usually present for logistics companies, such problems are presently still solved mainly manually by experienced planners and dispatchers. It is thus unsurprising that non-negligible to considerable savings can be obtained applying OR techniques.

Academic research typically focuses on VRPs with one, two, or three additional problem aspects such as, among many others, time-windows, legal break times, multi-depot, multi-tour, multiple compartments, dynamic, pickup and delivery [2][3][4]. However, to the best of the authors' knowledge, academic research in developing algorithms combining all practical constraints simultaneously are nonexistent or at least unpublished.

This contribution aims to emphasize the importance of researching solution approaches simultaneously considering all problem aspects. Since, often, effective algorithms or heuristics tackling a two-or-three-aspect-VRP variant break or lose their effectiveness in the presence of a third or fourth problem aspect. This can occur because the additional computational requirements are too great in the previous elegant problem representation or the problem representation is simply wholly insufficient.

We present a list of the most relevant problem aspects for logistics and industrial companies. Not all companies have need of all problem aspects simultaneously. However, it is impractical to develop and maintain algorithms used in daily operations for every possible combination of problem aspects leading to the requirement of a feature toggle. This means that the mega algorithm able to tackle all problem aspects simultaneously must be designed and implemented in such a way that when a certain aspect is not required, the performance would approximate a dedicated algorithm.

Lastly, we argue for the need of realistically sized benchmark instances combining many or all problem aspects relevant for logistics companies in practice.

References

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